

(12)

(19) GB (11) 2 373 174 (13) A

(13) **A**

(51) INT CL⁷
A47L 9/16

(52) UK CL (Edition T)
A4F FFD

(56) Documents Cited
WO 2001/045853 A

(58) Field of Search
UK CL (Edition S) A4F FFD
INT CL⁷ A47L 9/16
Online: WPI EPODOC JAPIO

(74) Agent and/or Address for Service
Withers & Rogers
Goldings House, 2 Hays Lane, LONDON, SE1 2HW,
United Kingdom

(57) Cyclone dust collecting apparatus comprises a cylindrical cyclone body 110 secured to the top of a dust collecting chamber 21 provided in a vacuum cleaner body 20, and is connected to an air drawing path 25 and an air discharging path 26, the cylindrical cyclone body having an air inlet and an air outlet corresponding to the air drawing path and the air discharging path, respectively. A dirt collecting container 120 is removably disposed adjacent a lower portion of the cyclone body 110, the dirt collecting container collecting dirt and contaminants centrifuged in the cyclone body. A partition plate (130, Fig 3) is disposed between the cyclone body 110, and the dirt collecting container 120. A first dirt path (115a, Fig 3) extends outwardly from one side of the bottom of the cyclone body 20 for discharging dust and contaminants, centrifuged at the cyclone body, into the dirt-collecting container 120. A second dirt path (120a, Fig 3) extends outwardly from a side of a top of the dirt collecting container 120 for discharging dust and contaminants, centrifuged at the cyclone body 110, into the dirt collecting container. The first and the second dirt paths (115a, 120a, Fig 3) are positioned so as to be aligned with one another.

GB 2373 174 A

FIG. 1

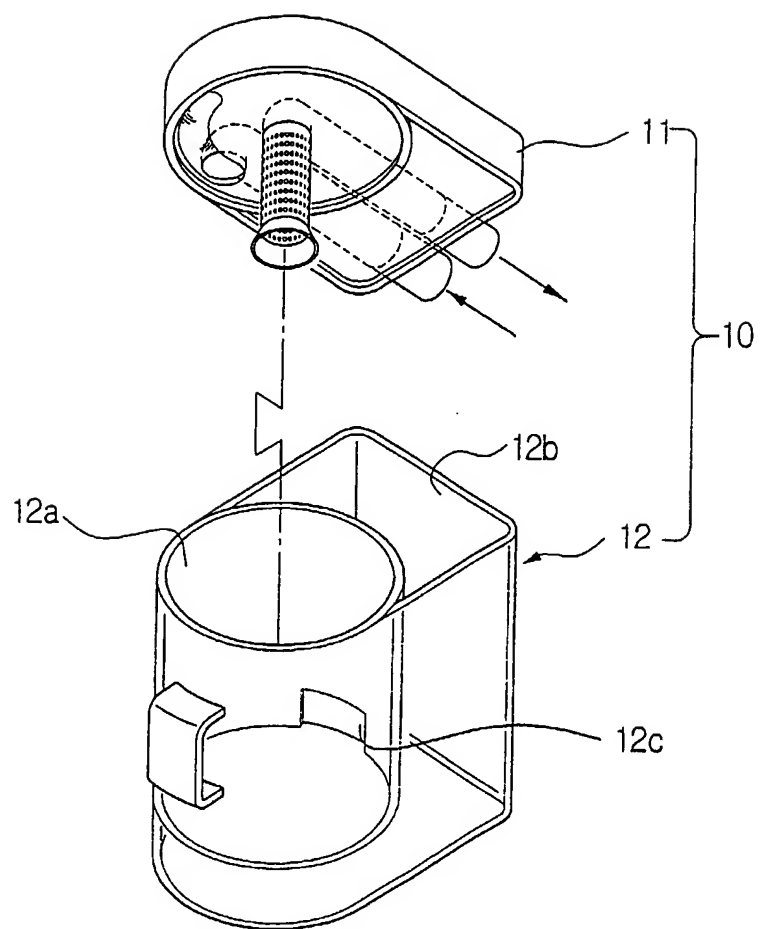
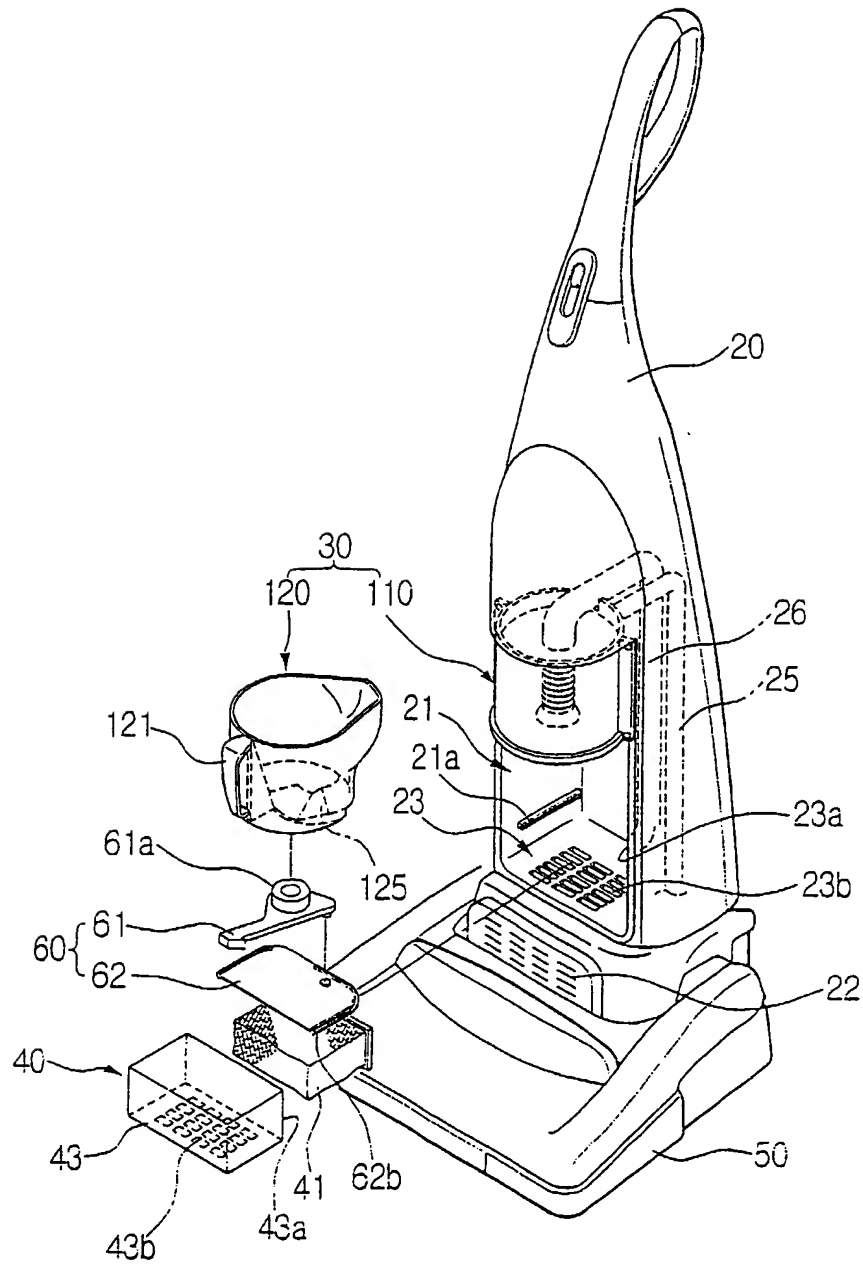


FIG.2



100

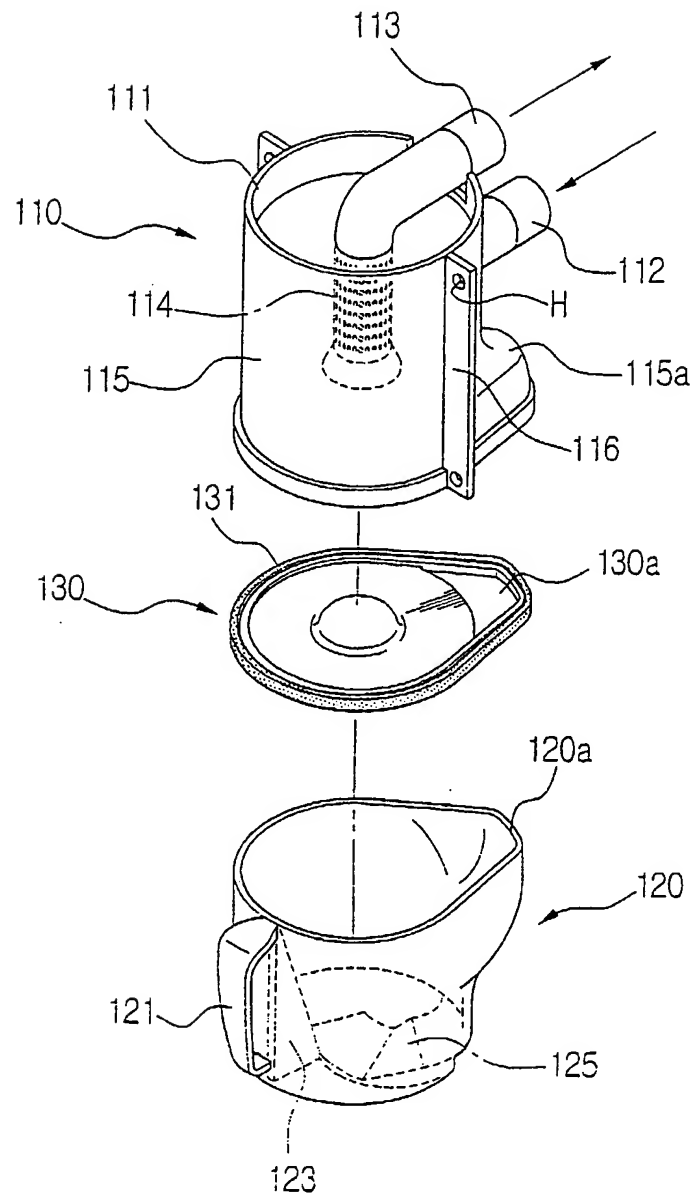


FIG.4

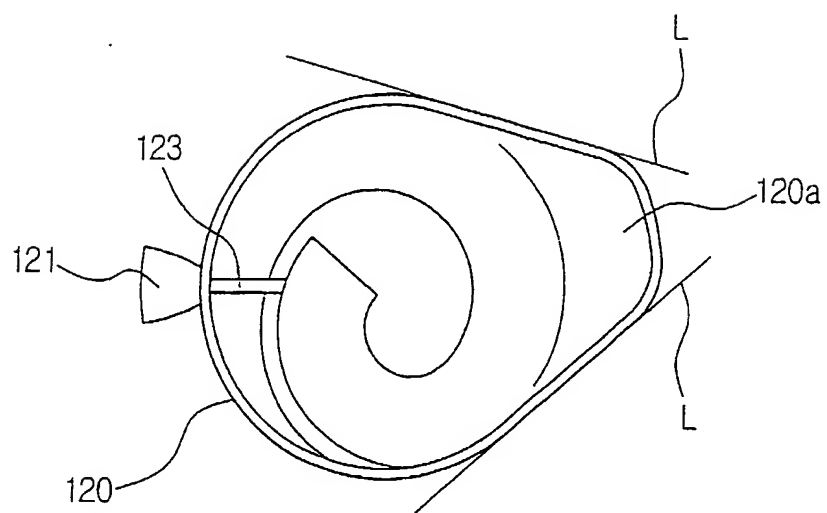


FIG. 5

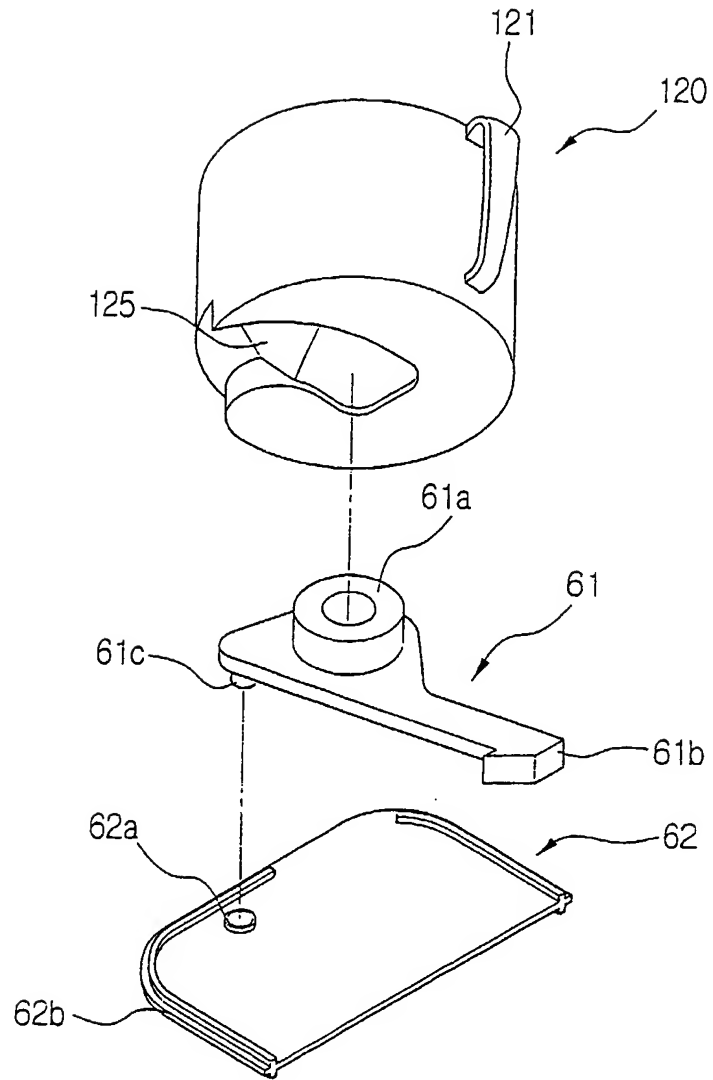
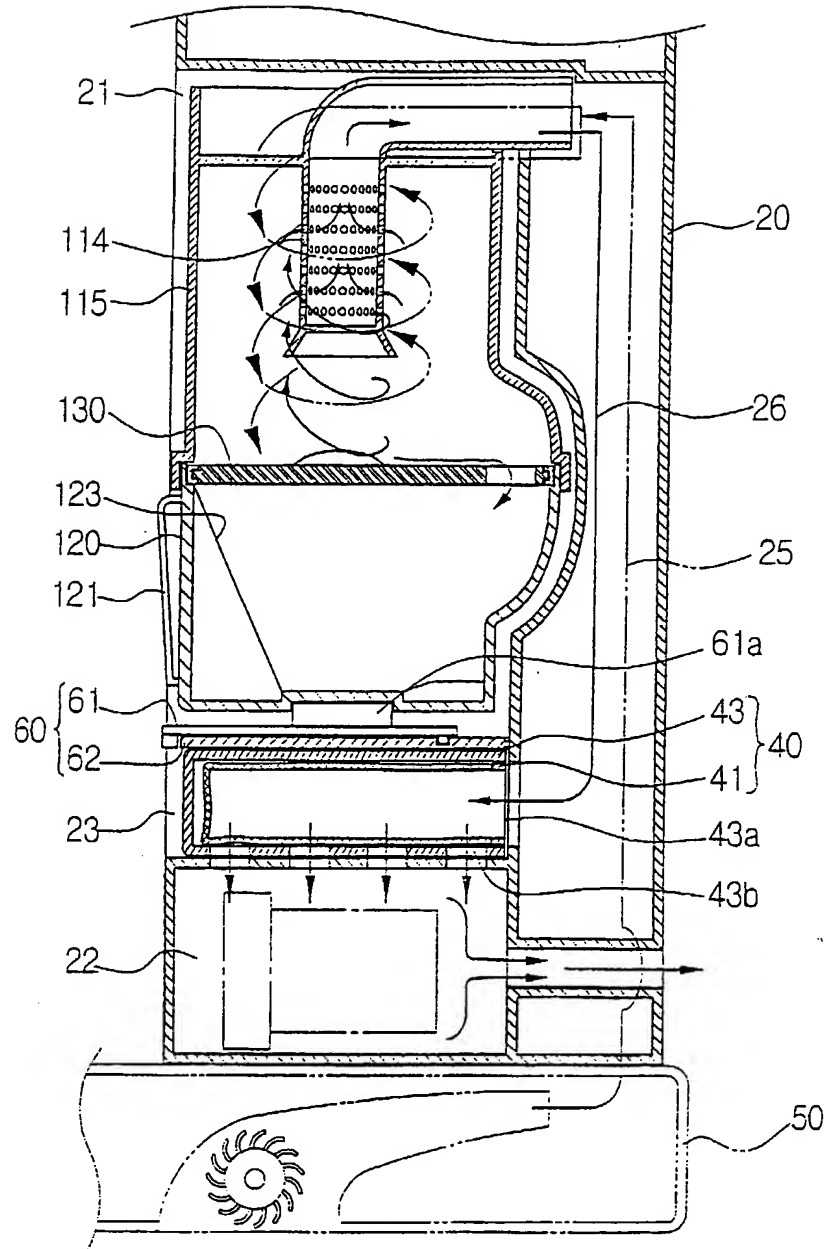


FIG. 6



DUST COLLECTION APPARATUS FOR A VACUUM CLEANER

The present invention relates to dust collecting apparatus, and more particularly, to cyclone dust collecting apparatus having a removable dirt collecting container.

5

Generally, upright-type vacuum cleaners which have cyclone dust collecting apparatus, comprise a brush connected to a cleaner body, the brush being arranged to move along a cleaning surface. The cleaner body is divided into a dust collecting chamber, for removably mounting the cyclone dust collecting apparatus, and a motor chamber for
10 mounting a motor which provides a suction force. In the above construction, when the motor is driven, a strong suction force is generated at the brush. Due to this suction force, dirt, or dust-laden air is drawn from the cleaning surface into the cleaner body. The air then flows into the cyclone dust collecting apparatus which is mounted in the dust collecting chamber of the cleaner body. The air is drawn into the cyclone dust
15 collecting apparatus forming a vortex rotating at high speed. Various contaminants entrained in the air are affected by the centrifugal force of the vortex, and are collected by the cyclone dust collecting apparatus. The clean air is then discharged externally through the motor chamber.

20 Figure 1 shows an example of conventional cyclone dust collecting apparatus. As shown in Figure 1, the cyclone dust collecting apparatus includes a cyclone body 11 and a cyclone housing 12. The cyclone housing 12 is divided into a centrifuging chamber 12a and a dirt collecting chamber 12b. An opening 12c is formed in a lower part of the centrifuging chamber 12a through which opening the centrifuging chamber 12a
25 communicates with the dirt collecting chamber 12b. Air that flows into the cyclone body 11 forms a vortex in the centrifuging chamber 12a. Contaminants entrained in the air are affected by the centrifugal force caused by the vortex, and are discharged with a certain amount of air into the dirt collecting chamber 12b through the opening 12c.

30 The process of emptying dust and contaminants from the cyclone dust collecting apparatus, when the dirt collecting chamber 12b is full, will now be described. Firstly,

the cyclone dust collecting apparatus is detached from the dust collecting chamber, and then the cyclone housing 12, in which the dust and contaminants are collected, is detached from the detached cyclone body. Then, the dust and contaminants in the dirt collecting chamber 12b of the cyclone housing 12 are tipped out.

5

According to a first aspect of the present invention, there is provided cyclone dust collecting apparatus for a vacuum cleaner, the dust collecting apparatus comprising: a generally cylindrical cyclone body for being secured to a top part of a dust collecting chamber which is provided in a vacuum cleaner body, and which is connectable to an
10 air drawing path, and to an air discharging path, the cylindrical cyclone body having an air inlet and an air outlet corresponding respectively, to the air drawing path and the air discharging path; a dirt collecting container removably disposed at a lower portion of the cyclone body, the dirt collecting container being arranged to collect dirt and contaminants which have been centrifuged at the cyclone body; a partition plate
15 disposed between the cyclone body and the dirt collecting container; a first dirt path protruding outwardly from one side of a bottom region of the cyclone body, the first dirt path being arranged to discharge the centrifuged dust and contaminants into the dirt-collecting container; and a second dirt path protruding outwardly from one side of a top region of the dirt collecting container, the second dirt path being arranged to
20 discharge the centrifuged dust and contaminants into the dirt collecting container, the first and the second dirt paths being arranged so as to correspond to one another.

According to a second aspect of the present invention, there is provided cyclone particle collecting apparatus for a vacuum cleaner, the particle collecting apparatus comprising:
25 a cyclone body for being secured within a vacuum cleaner, the cyclone body being arranged to generate a vortex air current; a particle collecting receptacle removably connected to the cyclone body and being arranged to receive particles from the cyclone body due to the vortex air current; and a partition disposed between the cyclone body and the particle collecting receptacle, the partition including an aperture through which
30 the particles are received by the particle collecting receptacle from the cyclone body.

In this way it is possible to provide cyclone dust collecting apparatus from which a dirt collecting container is detachable to allow collected dirt to be emptied without requiring the whole cyclone dust collecting apparatus to be detached from the rest of the vacuum cleaner.

5

The partition plate is preferably connected to an open bottom of the cyclone body, and has a dirt passage hole disposed at a position corresponding to the first and the second dirt paths. The first and the second dirt paths may be formed by walls which extend outwardly from the cyclone body and the dirt collecting container, respectively, in a tangential direction with respect to the outer surface of the cyclone body and the dirt collecting container. The second dirt path formed on the dirt collecting container preferably has a larger radius of curvature than that of the first dirt path, formed on the cyclone body.

15 The cyclone dust collecting apparatus may further comprise dirt rotation preventing means for preventing the dust and contaminants (flowing into the dirt collecting container) from rotating. This dirt rotation preventing means comprises at least one dividing piece protruding from an inner circumference of the dirt collecting container. The dividing pieces may extend obliquely from the top of the dirt collecting container, down to the bottom.

In the preferred embodiment, the cyclone body comprises a centrifuging container having a shape of a cylinder, of which both ends are open, a head having an air drawing pipe connected to the air drawing path for guiding the air obliquely with respect to the centrifuging container, and an air discharge pipe one end of which is connected to a grille protruding towards the open bottom of the centrifuging container. The other end is connected to the air discharging path. The head is connected to an open top of the centrifuging container.

30 The invention will now be described, by way of example, with reference to Figures 2 to 6 of the accompanying drawings, in which:

Figure 2 is an exploded perspective view showing an upright-type vacuum cleaner including cyclone dust collecting apparatus in accordance with the invention;

Figure 3 is an exploded perspective view of the cyclone dust collecting apparatus of Figure 2;

Figure 4 is a plan view of a dirt collecting container;

Figure 5 is an exploded perspective view showing attaching/detaching means; and

Figure 6 is a cross-sectional view of part of the upright-type vacuum cleaner of Figure 2, when assembled.

Referring to Figure 2, an upright-type vacuum cleaner comprises a cleaner body 20, a brush 50 disposed in a lower portion of the cleaner body 20, dust filtering means 40, and cyclone dust collecting apparatus 30 mounted in a dust collecting chamber 21 of the cleaner body 20.

The dust collecting chamber 21 of the cleaner body 20 is used to mount the cyclone dust collecting apparatus 30 therein. Also in the cleaner body 20 is a motor chamber 22 for mounting a motor (not shown), and a filtering chamber 23 for removably mounting the dust filtering means 40. The dust collecting chamber 21 is connected to an air drawing path 25 and an air discharging path 26. The air drawing path 25 is connected to the brush 50. Thus, the dust and/or contaminant-laden air drawn in at the brush 50 from a cleaning surface flows into the dust collecting chamber 21, through the air drawing path 25. Also, the air discharging path 26 is connected to the motor chamber 22, and has the filtering chamber 23 formed therein and is connected to the motor chamber 22. Thus, air which is discharged from the dust collecting chamber 21 flows through the air discharging path 26, the filtering chamber 23, and the motor driving means 22, and is then discharged. The filtering chamber 23 has an air inlet 23a corresponding to the air-discharging path 26, and an air outlet 23b corresponding to the

motor chamber 22. The air inlet 23a is formed in a sidewall of the filtering chamber 23, and the air outlet 23b is formed at the bottom of the filtering chamber 23.

5 The dust filtering means 40 are disposed in the filtering chamber 23 and means 40 comprise an air filter 41 and a filter case 43. The air filter 41 is made of a material having minute air passage holes for filtering any remaining dust which has not been separated by the cyclone dust collecting apparatus 30, disposed in the dust collecting chamber 21. The air filter 41 may be one as is used generally in cleaners, and so a detailed description is omitted. The filter case 43 has an air intake 43a, connecting to
10 the air drawing path 26, and an air exhaust 43b, connected to the motor chamber 22. Thus, the air intake 43a of the filter case 43 corresponds to the air inlet 23a of the filtering chamber 23, and the air exhaust 43b corresponds to the air outlet 23b of the filtering chamber 23.

15 The brush 50 is disposed at the lower portion of the cleaner body 20 and, in use, moves along the cleaning surface. The dust and contaminant-laden air, from the cleaning surface, is drawn in at the brush 50 by a suction force generated by the motor in the motor chamber 22. Preferably, the brush 50 is movably disposed with respect to the cleaner body 20.

20

The cyclone dust collecting apparatus 30 comprises a cyclone body 110, a dirt collecting container 120, and a partition plate 130.

The cyclone body 110 is screwed onto an upper portion of the dust collecting chamber
25 21. As shown in Figure 3, the cyclone body 110 has a head 111 and a cylindrical centrifuging container 115.

The head 111 includes an air drawing pipe 112, connected to the air drawing path 25, an air discharging pipe 113, connected to the air-discharging path 26, and a grille 114
30 for filtering out dust. The head 111 is connected to the top of the centrifuging container 115. The air drawing pipe 112 is formed in a manner whereby one end is connected to the air drawing path 25 of the cleaner body 20, and the other end is formed so as to

discharge the air, obliquely, with respect to the centrifuging container 115. One end of the air-discharging pipe 113 is connected to the air-discharging path 26 of the cleaner body 20, and the other end thereof is connected to the grille 114. The grille 114 protrudes, or extends, towards an open bottom part of the centrifuging container 115, and is in the shape of a cylinder. The grille 114 has a plurality of minute holes formed in a surface thereof.

The centrifuging container 115 is a generally cylindrical container in which the top and bottom are open. The wall of the container in the lower region extracts xxxxxx beyond the cylinder defined by other parts of the wall to define a first dirt path 115a which is on one side of the cyclone chamber and which is downwardly open. More specifically, the first dirt path 115a protrudes from a side region at the bottom of the centrifuging container 115 in a generally tangential direction with respect to the outer surface of the centrifuging container 115. Accordingly, the lower portion of the centrifuging container 115 is of a non-circular form. As such, air flows into the centrifuging container 115 and forms a vortex. The air descends downwards along the inner circumference of the centrifuging container 115 and is then discharged to the dirt collecting container 120, through the first dirt path 115a.

A support 116 having a hole H formed therein is provided protruding from the outer circumference of the centrifuging container 115. This support 116 is for securing the centrifuging container 115 to the dust collecting chamber 21 by securing means such as a screw, or the like.

The dirt collecting container 120 is of a cylinder type, of which the top is open and the bottom is closed, this closed end corresponding to the bottom of the centrifuging container 115. A second dirt path 120a is formed at the top of the dirt collecting container 120, and is arranged to correspond to the first dirt path 115a. As shown in Figure 4, the second dirt path 120a protrudes from one end of the top of the dirt collecting container 120, outwardly, in a tangential direction L, with respect to the outer surface of the dirt collecting container 120. The top of the dirt collecting container 120 and the bottom of the centrifuging container 115 are identical to one other, in plan

view, so as to allow them to be secured to each other closely. A grip 121 is disposed on an outside part of the dirt-collecting container 120.

Preferably, the dirt collecting container 120 comprises a dirt rotation preventing means, 5 formed therein, for preventing dust and contaminants, flowing in the first dirt and second paths 115a and 120a, from rotating. The dirt rotation preventing means comprises a dividing piece 123 extending downwards along the inner circumference of the dirt-collecting container 120, from the top to the bottom of the dirt collecting 10 the dirt collecting container 120, from rotating, thereby preventing a back-flow of dirt into the first and second dirt paths 115a, 120a.

The partition plate 130 is disposed between the centrifuging container 115 and the dirt 15 collecting container 120. Preferably, the partition plate 130 is press-fitted to the top of the dirt collecting container 120. Accordingly, the partition plate 130 has a plate shape or figure corresponding to the bottom of the centrifuging container 115, to the top of the dirt collecting container 120, and having a dirt passage hole 130a formed at a side region so as to correspond to the first and the second dirt paths 115a and 120a. Thus, the partition plate 130 not only prevents the centrifuging container 115 and the dirt 20 collecting container 120 from communicating with each other directly in the vertical direction, but also functions to communicate the first dirt path 115a to the second dirt path 120a, thereby allowing effective collection of the centrifuged dirt and contaminants in the dirt collecting container 120. Preferably, a sealing element is disposed on an edge of the partition plate 130 for securely sealing the bottom of the 25 centrifuging container 115.

As shown in Figure 6, the first and the second dirt paths 115a and 120a are respectively formed, in the shape of a generally semi-circular arc having a predetermined radius of curvature. The second dirt path 120a of the dirt collecting container 120 preferably has 30 a larger curvature radius than that of the first dirt path 115a. Accordingly, dirt flowing into the first dirt path 115a of the centrifuging container 115a flows quickly into the second dirt path 120a, where the radius of curvature gets larger as it slopes in a

downwards direction such that the dirt is rapidly collected at the dirt collecting container 120. The first and the second dirt paths 115a and 120a are formed integrally with the centrifuging container 115 and the dirt collecting container 120, respectively, by approximately forming each end of the centrifuging container 115 and the dirt collecting container. Therefore, there is no need for extra manufacturing processes in making the centrifuging container 115 and the dirt collecting container 120. Also, the first and the second dirt paths 115a and 120a are formed in a lop-sided manner such that discharge of dirt can be performed satisfactorily, and also, the back- flow of dirt can be prevented effectively.

10

There is further provided a connecting/disconnecting means 60 for mounting and removing the dirt collecting container 120 to or from the bottom of the centrifuging container 115, in the dirt collecting chamber 21, more easily.

15 As shown in Figure 5, the connecting/disconnecting means 60 comprises an inclined recess 125 formed at the bottom of the dirt-collecting container 120, a securing element 61 having a protrusion 61a formed thereon to correspond to the inclined recess 125, and a base 62 for supporting the dust collecting apparatus 30 and allowing relative movement of the securing element 61, with respect to the inclined recess 125.

20

The inclined recess 125 is formed in the shape of spiral, of which the depth gets deeper from the centre region, towards the outer circumference of the dirt collecting container 120.

25 The securing element 61 comprises a pivot pin 61c formed on one end thereof, which acts as a pivot, a lever 61b formed on the other end thereof, for allowing a user to turn the element and the protrusion 61a, the protrusion being formed between both ends of the securing element 61 and corresponding to the inclined recess 125.

30 The base 62 comprises a connecting protrusion 62b, corresponding to a guide recess 21a formed on an inner wall of the dust collecting chamber 21, and is thus mounted in

the dust-collecting chamber 21 in a removable manner. The base 62 also comprises a hole 62a corresponding to the pivot pin 61c of the securing element 61.

5 In the connecting/disconnecting means 60 as described above, if the user turns the lever 61b of the securing element 61 in one direction (say, in a clockwise direction as shown in Figure 5), the protrusion 61a moves along the inclined recess 38.

10 The operation of an upright-type vacuum cleaner, employing a cyclone dust collecting apparatus thereon, in accordance with the above-described embodiment is described below.

When the motor of the motor chamber 22 is driven, a suction force is generated at the brush 50. Due to the suction force, dust and contaminant-laden air, from the cleaning surface, is drawn into the cyclone body 110 through the brush 50 and the air drawing
15 path 25. At this time, air flows obliquely along the inner circumference of the centrifuging container 115 (to the air drawing pipe 112 of the head 111) and into a vortex current. Relatively large dust or contaminants which are entrained in the air are centrifuged by the vortex, and are discharged into the dirt collecting container 120 via the first and the second dirt paths 115a and 120a. The discharged dust and
20 contaminants are collected at the bottom of the dirt collecting container 120. The collected dirt and contaminants do not flow back into the centrifuging container 115, since the centrifuging container 115 is closed by means of the partition plate 130. Furthermore, flow or rotation of the dust and contaminants, collected at the dirt collecting container 120, is restricted, due to the presence of the dividing piece 123.
25 Accordingly, back-flow through the first and the second dirt paths 115a, 120a is prevented.

Meanwhile, air 'cleaned' in the cyclone body 31 is discharged to the air-discharging pipe 113 through the minute passage holes of the grille 114 of the head 111. The
30 'cleaned' air flows from the air discharging pipe 113 into the filter case 43 of the filtering chamber 23 through the air-discharging path 26. As air flows the filter case 43, relatively minute dust particles which are not separated by the cyclone dust collecting

apparatus 30 are filtered through the air filter 41. The remaining 'cleaned' air flows into the motor chamber 22 and is then discharged.

5 Since a method for mounting and removing a dirt collecting container 120 on and from the dust-collecting chamber 21 is disclosed in detail in the applicant's British Patent Application No. 0118379.7 the description thereof is omitted here.

10 In the upright-type vacuum cleaner described above, it is not necessary to remove the whole cyclone dust collecting apparatus 30 from the dust collecting chamber 21 in order to empty out collected dust and contaminants. The dirt collecting container 120, which holds dust and contaminants therein, can be removed from the vacuum cleaner. Accordingly, it is more convenient for the user to empty collected dust and contaminants from the dust collecting apparatus.

15 Further, since the first dirt path 115a and the second dirt path 120a are formed integrally with the centrifuging container 115 and the dirt-collecting container 120, respectively, by forming each end of the centrifuging container 115 and the dirt collecting container so as to correspond to one another, the structure is simplified, and the efficiency of discharging dirt and back flow prevention are enhanced.

20

While an upright-type vacuum cleaner employing cyclone dust collecting apparatus is described above, such description is for illustrative purpose only, and it is to be understood that the cyclone dust collecting apparatus may be employed in a canister-type vacuum cleaner, or in a portable vacuum cleaner, as alternatives.

CLAIMS

1. Cyclone dust collecting apparatus for a vacuum cleaner, the dust collecting apparatus comprising:
 - 5 a generally cylindrical cyclone body for being secured to a top part of a dust collecting chamber which is provided in a vacuum cleaner body, and which is connectable to an air drawing path, and to an air discharging path, the cylindrical cyclone body having an air inlet and an air outlet corresponding respectively, to the air drawing path and the air discharging path;
 - 10 a dirt collecting container removably disposed at a lower portion of the cyclone body, the dirt collecting container being arranged to collect dirt and contaminants which have been centrifuged at the cyclone body;
a partition plate disposed between the cyclone body and the dirt collecting container;
 - 15 a first dirt path protruding outwardly from one side of a bottom region of the cyclone body, the first dirt path being arranged to discharge the centrifuged dust and contaminants into the dirt-collecting container; and
a second dirt path protruding outwardly from one side of a top region of the dirt collecting container, the second dirt path being arranged to discharge the centrifuged
20 dust and contaminants into the dirt collecting container, the first and the second dirt paths being arranged so as to correspond to one another.
2. Apparatus according to claim 1, wherein the partition plate is connected to an open bottom of the cyclone body, and has a dirt passage hole disposed at a position
25 corresponding to the first and the second dirt paths.
3. Apparatus according to claim 1 or claim 2, wherein the first and the second dirt paths protrude outwardly from the cyclone body and the dirt collecting container, respectively, in a tangential direction with respect to outer surfaces of the cyclone body
30 and the dirt collecting container.

4. Apparatus according to any preceding claim, wherein the second dirt path has a larger radius of curvature than that of the first dirt path.
5. Apparatus according to any preceding claim, further comprising dirt rotation preventing means for preventing dust and contaminants, which are in the dirt collecting container, from rotating.
6. Apparatus according to claim 5, wherein the dirt rotation preventing means comprises at least one dividing piece protruding from an inner circumference of the dirt collecting container.
7. Apparatus according to claim 6, wherein the dividing piece extends obliquely, from the top of the dirt collecting container, to the bottom thereof.
8. Apparatus according to any preceding claim, wherein the cyclone body comprises:
a generally cylindrical centrifuging container, both ends of which are open; and
a head, having an air drawing pipe connected to the air drawing path for guiding air to flow obliquely, with respect to the centrifuging container, and an air discharging pipe, one end of which is connected to a grille protruding towards the open bottom of the centrifuging container, the other end being connected to the air discharging path, the head being connected to an open top of the centrifuging container.
9. Cyclone particle collecting apparatus for a vacuum cleaner, the particle collecting apparatus comprising:
a cyclone body for being secured within a vacuum cleaner, the cyclone body having an air inlet and an air outlet and being arranged to generate a vortex air current;
a particle collecting receptacle removably connected to the cyclone body and arranged to receive particles from the cyclone body due to the vortex air current; and
a partition disposed between the cyclone body and the particle collecting receptacle, the partition including an aperture through which the particles are received by the particle collecting receptacle from the cyclone body.

10. Apparatus according to claim 9, wherein the partition comprises means for securing the cyclone body to the particle collecting container.
- 5 11. Apparatus according to claim 9 or claim 10, wherein the particle collecting container and cyclone body are each formed with an outwardly-projecting portion so as to define a passage through which particles are transferred from the cyclone body to the particle collecting container, the partition aperture being provided at a position corresponding to the passage.
- 10 12. Apparatus according to any of claims 9 to 11, wherein the particle collecting container comprises a protrusion arranged to restrict circulation of particles held within the particle collecting container.
- 15 13. Apparatus according to claim 12, wherein the protrusion comprises a divider member extending from a position at the upper region of the particle collecting container, towards a position at the bottom of the particle collecting container.
- 20 14. A vacuum cleaner comprising a cyclone dust collecting apparatus according to any preceding claim, the cyclone body being fixed in the cleaner.
15. A vacuum cleaner according to claim 14, wherein the partition plate is detachable from the cyclone body with the particle collecting container.
- 25 16. A cyclone dust collecting apparatus constructed and arranged substantially as hereinbefore described and shown in Figures 2 to 6 of the accompanying drawings.
17. A vacuum cleaner constructed and arranged substantially as hereinbefore described and shown in Figures 2 to 6 of the accompanying drawings.



INVESTOR IN PEOPLE

Application No: GB 0121682.9
Claims searched: 1-8, 14, 15

Examiner: Nicholas Mole
Date of search: 29 October 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): A4F FFD

Int Cl (Ed.7): A47L 9/16

Other: Online: WPI EPODOC JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A, P	WO 01/45853 A (DYSON)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.